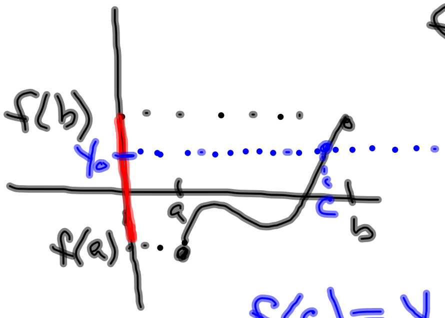
review 4 Intermediate value theorem
Extreme value Theorem
Polar, Parametric, Vector functions

Intermediate Value Theorem



$f(x)$ is continuous on $[a,b]$

then $f(x)$ takes every value between $f(a)$ and $f(b)$

$f(c) = y_0$

$a \leq c \leq b$

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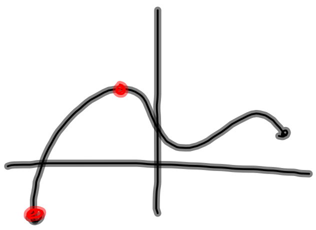
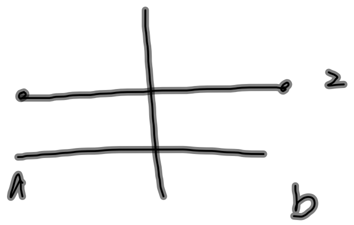
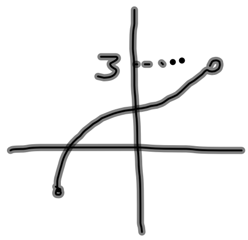
Extreme Value Theorem

If $f(x)$ is continuous on $[a,b]$

then $f(x)$ has a max & a min on $[a,b]$







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Polar Functions

$r = f(\theta)$

conversions:

$x = r\cos\theta$

$y = r\sin\theta$

$r = \sqrt{x^2+y^2}$

$\theta = \tan^{-1}\frac{y}{x}$

add π to θ if the point is in QII or QIII ($x<0$)

famous polar graphs

$r=1$ circle

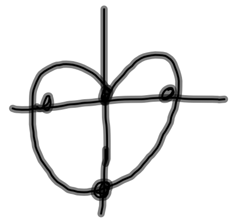
leafed rose { $r=\cos(n\theta)$, $r=\sin(n\theta)$ }

n leaves if n odd

2n leaves if n even

cardioid $r = 1 \pm \cos\theta$

$r = 1 \pm \sin\theta$



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slope $= \frac{dy}{dx} = \dfrac{dy/d\theta}{dx/d\theta}$

area in a polar curve

$$\int_{\theta_1}^{\theta_2} \frac{1}{2} r^2 \, d\theta$$

area between 2 polar curves

$$\int_{\theta_1}^{\theta_2} \frac{1}{2}R^2 - \frac{1}{2}r^2 \, d\theta$$

intersection points (θ_1, θ_2)

R: further from origin

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parametric equations

$x = f(t)$

$y = g(t)$

slope $= \frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$

$\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{dx/dt}$

arc length

$$\int_{t_1}^{t_2} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$$

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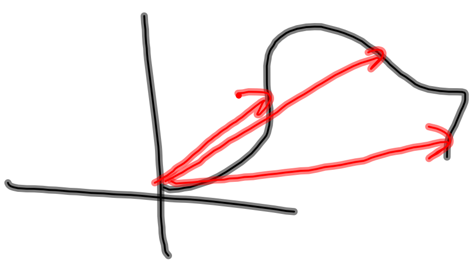
vector functions

$\hat{r}(t) = f(t)\,\hat{i} + g(t)\,\hat{j}$

$= \langle f(t), g(t) \rangle$ (x = f(t), y = g(t))

graph vector functions in parametric mode



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